

accordance with the Examiner's suggestion and to correct a typographical error, respectively. Claim 9 has been amended into independent format, on the basis that the claim has been indicated as allowable and, for the reasons set forth below, the rejection of claim 9 under Section 112 should be withdrawn. The paragraph at page 20, line 16 to page 22, line 2, has been amended to correct the formatting, in accordance with the Examiner's request in the Office action. This paragraph has not been substantively amended in any manner, and contains no new matter. The specification at page 73, lines 9-10, has been amended to correct a spelling error.

Applicants respectfully request reconsideration of the rejections set forth in the Office action dated April 4, 2002, based on the foregoing amendments and the following remarks.

#### **Applicants' Invention**

Applicants' invention relates to a method for treating a metal substrate to improve adhesion of polymeric substances thereto, including steps of intergranular etching a surface of the metal substrate, and applying an immersion plated metal to the intergranular etched surface by immersing the surface in an immersion plating composition containing one or more specified metals. Thus, the present invention solves the problem of improving adhesion of polymeric substances such as PCB laminating materials, which has been a long standing problem in the prior art.

The methods of the prior art do not provide the features provided by Applicants' claimed invention. The present invention, taken as a whole, provides a new and nonobvious improvement over the methods of the prior art. The methods of the prior art attempt to solve the problem of improving adhesion of polymeric substances to metal surfaces in other ways, which are neither the same as, nor so similar to as to

render obvious, Applicants' invention. The particular prior art references cited against Applicants' claims are discussed in more detail in the following.

### Immersion Plating

Persons of ordinary skill in the art of metal deposition recognize that there are many methods by which metal may be deposited on a surface, and the term "immersion plating" has a distinct and well-recognized meaning in the art. There are two general methods of depositing metal on a surface from an aqueous solution, broadly designated electrolytic and non-electrolytic deposition. Electrolytic deposition relies upon an electric current from a rectifier to deposit metal ions as metal atoms on a conductive surface. In the process of being deposited on the surface, electrons are added to the metal, and the metal ions are neutralized.

Non-electrolytic deposition includes two sub-types, designated in the art as "electroless" and "immersion". The characteristic that differentiates the two processes, electroless and immersion, has to do with the plating process itself.

In an electroless plating solution, the electrons causing the deposition of metal ions are obtained from a chemical in the solution, which is called a reducing agent. For example, in an electroless copper bath, formaldehyde may be the reducing agent. In an electroless nickel the reducing agent may be, for example, hypophosphite or dimethyl amine borane. The thickness of a metal deposited by electroless plating is theoretically not limited.

In an immersion plating bath, the electrons are supplied by the substrate metal, and effectively the substrate metal is the reducing agent. As the substrate metal donates electrons to the metal being deposited, the substrate metal itself goes into solution. For this reason, immersion plating is also called replacement plating or a replacement reaction. A key characteristic of the immersion plating bath is that it is

self limiting, which means that once the base metal, for example, copper, is covered, the plating ceases. This makes it possible to obtain a very thin, dense, non-porous coating on the substrate.

The differences between these types of metal deposition are well known in the art. Immersion plating has a well-defined and clearly understood meaning in the art. Immersion plating is not simply a generic term for any kind of process in which a substrate is immersed in a solution for deposition of a metal on the substrate.

**Rejection of Claims 1-8, 10-25, 28-32 and 53-63 over Mikado et al.**

Claims 1-8, 10-25, 28-32 and 53-63 stand rejected as anticipated by U.S. Patent No. 6,242,079 to Mikado et al. Claim 1 has been amended to specify intergranular etching solutions which distinguish the presently claimed invention from that of Makido et al. Specifically, the elements of claims 32, 38, 42, 49 and 53 have been incorporated into claim 1, with appropriate amendment in specific cases, as elements (1), (2), (3), (4) and (5), respectively, of amended claim 1. Claims 28-31 have been canceled. The elements of claim 32 (element (1) of amended claim 1) have been amended to specify that the acid is a mineral acid, an alkyl sulfonic acid or fluoroboric acid, or a mixture of these, as disclosed, for example, at page 14, lines 20-24. The elements of claim 53 (element (5) of amended claim 1) have been amended to specify the metals originally recited in claim 59 (now canceled) and to specify the complexing agents identified, for example, on page 25 of the specification. Two of these complexing agents were originally specified in claim 61, which is also canceled.

With respect to the Examiner's assertions relating to intergranular etching, Applicants note that, as discussed below with respect to the Section 112, first paragraph rejection of claim 9, one purpose of the various inhibitors used in the intergranular etching solutions is to specifically direct the etchants to the grain

boundaries. Thus, while it may be generally correct that any etchant will etch grain boundaries to some extent, the present invention seeks to employ only those etchants which more selectively attack the grain boundaries and so result in deeper crevices in the etched surface.

Mikado et al fails to disclose or suggest the specific intergranular etching solutions set forth in amended claim 1.

Regarding claims 5-8, as noted by the Examiner, Mikado et al discloses concentrations of anchor portions and ridge portions at column 11, but Applicants are unaware of any specific teaching in Mikado et al of aspect ratios. With respect to the Examiner's reliance upon the Mikado et al drawings for the aspect ratios, it is old and well-established law that patent drawings are not to be relied upon for exact scale, absent some specific disclosure of the exact dimensions intended. Regarding the Examiner's reliance on Figs. 1-3 of Mikado et al, it is unclear how the Examiner arrived at the statement:

The SEMs of figures 1, 2, and 3 show a 1-micron square wherein at least 90% of the squares include at least one intergranular surface having an aspect ratio of at least 1. In specific regard to claim 8, FIG. 6 shows an aspect ratio of at least 2, and the SEMs of FIGS 1-3 show the requisite concentration.

The scale of Figs. 1-3 does not lend itself to such counting of 1-micron squares, and as noted above, there is no indication that the surfaces of Figs. 1-3 have any particular aspect ratio. Accordingly, Applicants request the Examiner to reconsider and withdraw the rejection of claims 5-8 over Mikado et al.

Regarding claims 13-15, the disclosure cited by the Examiner, col. 21, line 3, relates to silane treatment of  $\text{SiO}_2$  spherical beads, not to the silane treatment of an intergranular etched, immersion plated surface. Thus, this rejection is incorrect and should be withdrawn.

Regarding claim 18, the disclosure cited by the Examiner, col. 18, lines 60-65, relates to electroless plating, not to immersion plating. Thus, this rejection is incorrect and should be withdrawn.

Regarding claim 20, the disclosure cited by the Examiner, col. 29, lines 61-67, relates to electroless gold deposition on nickel, not on copper. Thus, this rejection is incorrect and should be withdrawn.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 1-8, 10-25, 28-32 and 53-53 over Mikado et al, for at least the foregoing reasons.

#### **Rejection of Claim 1 over Angell**

Claim 1 stands rejected as anticipated by U.S. Patent No. 3,650,861 to Angell. Applicants respectfully traverse this rejection. As stated by the Examiner, Angell discloses electroplating with platinum. Applicants' claims specify that the intergranular etched surface is immersion plated. As known to those of skill in the art, immersion plating is completely distinct and different from electroplating. See Applicants' discussion of immersion plating above. Accordingly, Angell fails to disclose all the limitations of Applicants' claimed invention, and cannot anticipate.

The Examiner is respectfully requested to withdraw this rejection.

#### **Claims Rejected as Obvious over Mikado et al in view of Secondary References**

Applicants' claims 26, 27 and 33-52 stand rejected as obvious over Mikado et al, in view of one or more secondary references. Applicants respectfully traverse these rejections for the following reasons.

As an initial matter, the amendment of claim 1, which Applicants respectfully submit fully distinguishes the claimed invention over Mikado et al, removes the basis

for all of the rejections under Section 103, since Mikado et al is the primary or an important reference underlying all of the Section 103 rejections. Accordingly, on this basis, Applicants respectfully request the Examiner to withdraw the rejections of claims 26, 27 and 33-52 over Mikado et al in view of the secondary references.

Also, the following points with respect to the independent claims which have been incorporated into claim 1 are set forth with respect to the claims as if they were still separate, but it will be understood that these arguments pertain to these particular elements of claim 1 as now amended.

With regard to claims 33-37, rejected as obvious over Mikado et al in view of Shibasaki et al, a person of skill in the art would not combine these references, since Shibasaki et al use a peroxide/sulfuric acid etchant and Mikado et al repeatedly teach away from the use of such an etchant. See, for example, Mikado et al at col. 1, line 65, col. 2, line 23, col. 4, lines 4-5 and col. 5, lines 49-60. Since Mikado et al clearly teaches away from the use of the etchant of Shibasaki et al, a person of skill in the art would not look to Shibasaki et al for combination with Mikado et al. Thus, there is no motivation to make the asserted combination of references, there would be no reasonable expectation of success in the combination, so there can be no basis for an obviousness rejection based on this combination. The rejection of these claims should therefore be withdrawn.

With regard to claims 38-40 (element (2) of amended claim 1), also rejected as obvious over Mikado et al in view of Shibasaki et al, the Examiner asserted that Mikado et al teach all the elements of claim 38 except for the concentration of hydrogen peroxide. This is erroneous, since Mikado et al fail to teach or suggest a corrosion inhibitor. The only mention of "corrosion" in Mikado et al is at col. 11, line 56, (cited by the Examiner at page 7 of the Office Action). This disclosure relates to a metal layer which prevents corrosion, not to an element of an etchant solution, as

recited in claims 38-41. In addition, the phosphoric acid taught by Mikado et al at col. 18, lines 33 et seq. relates to roughening the surface of an interlaminar resin insulating layer (see col. 18, lines 23-24), not to an intergranular etchant solution for a metal surface as described in claim 38 (now an element of claim 1). The Examiner is not permitted to pick and choose among isolated, unrelated disclosures to make an obviousness rejection. The rejection of these claims should therefore be withdrawn.

With regard to claim 41, rejected over Mikado et al in view of Price et al, this claim distinguishes over Mikado et al for the same reasons as do claims 38 and 1, and Applicants submit that Price et al fails to remedy the shortcomings of Mikado et al discussed above.

With regard to claims 42, 43, 46 and 49-52, rejected as obvious over Mikado et al in view of Schemenaur et al, this claim distinguishes over Mikado et al for the same reasons as does claim 1, and Applicants submit that Schemenaur et al fails to remedy the shortcomings of Mikado et al discussed above.

With regard to claims 49-52 (element (4) of amended claim 1), Schemenaur et al disclose that the acid concentration is typically between 0.5 and about 7.5 moles per liter. The Examiner pointed to Schemenaur et al's claim 9 for the aromatic sulfonic acid. Assuming that the phenylsulfonic acid of claim 9 is used at the 0.5 moles per liter minimum disclosed by Schemenaur et al, Applicants respectfully submit that there is no overlap between the concentration of Schemenaur et al and the claimed concentration, as follows.

Phenylsulfonic acid has the empirical formula  $C_6H_4SO_3H$ . This formula has a molecular weight of  $72 + 4 + 32 + 48 + 1 = 157$  grams per mole. At a concentration of 0.5 moles per liter, there are 78.5 grams per liter, or 7.85 grams per 100 ml. This is equivalent to a concentration of 7.85 % w/v, which is clearly outside the range

claimed by claims 49-52, i.e., 0.01 to 5% w/v of an aromatic sulfonic acid or a salt thereof.

Accordingly, Applicants respectfully request withdrawal of the rejection of claims 49-52 over Mikado et al in view of Schemenaur et al.

With regard to claims 26 and 27, rejected as obvious over Mikado et al in view of Palladino, Applicants traverse this rejection for the following reasons. First, as noted above, amended claim 1 is considered to fully distinguish over Mikado et al, and Palladino fails to remedy the shortcomings of Mikado et al. Second, claims 26 and 27 depend from claim 13 and, as noted above with respect to the rejection of claims 13-15 over Mikado et al, the disclosure cited by the Examiner, col. 21, line 3, relates to silane treatment of SiO<sub>2</sub> spherical beads, not to the silane treatment of an intergranular etched, immersion plated surface. Third, there is no suggestion in Mikado to use a silane for treatment of the metal coated surface. Thus, there is no motivation to look to Palladino for any specific silane. Finally, with respect to claim 27, Palladino fails to disclose or suggest a trimethoxysilylpropyl modified polyethyleneimine. Thus, this rejection is incorrect and should be withdrawn.

**Rejection of Claims 42-48 over WO 99/40764 in view of Mikado et al  
and further in view of Holtzman et al**

Claims 42-48 stand rejected over Grieser et al (WO 99/40764) in view of Mikado et al and further in view of Holtzman et al. Applicants respectfully traverse this rejection for at least the following reasons.

As admitted by the Examiner, Grieser et al do not disclose or suggest an immersion plating step as claimed in the present claims. Similarly, while Holtzman et al describe immersion plating, Holtzman et al appear to teach away from etching surfaces to improve adhesion of polymeric substances thereto, instead teaching that the immersion plated tin is sufficient to provide improved adhesion. Holtzman et al



mention persulfate etching at col. 4, line 16, and mention persulfate or sulfuric/hydrogen peroxide at col. 4, lines 40-42. However, this disclosure is in a section discussing the problems of the prior art. The disclosure of Holtzman et al would not provide any motivation to a person of skill in the art to seek to combine an etching method such as that of Grieser et al with the etchants mentioned in a disparaging way by Holtzman et al. While it is correct that Grieser et al disclose some of the features of claims 42-48 (of course, Applicants specifically cited Grieser et al as the source of these features at page 18 of the specification), there is simply no motivation to combine the teachings of Grieser et al with those of Holtzman et al.

With regard to the asserted combination of Grieser et al and Holtzman et al, the Examiner is respectfully reminded that it is the claimed combination as a whole which is patentable, and that virtually all patented inventions comprise elements known in the prior art. This has been explicitly recognized by the courts and the PTO for many years. Thus, it is the combination which must be considered. The fact that elements of the combination can be found in the prior art is not determinative of obviousness. One of the necessary elements of any obviousness determination is the presence of a motivation to combine references. Applicants respectfully submit that such motivation is lacking with respect to the present claims, or to claim 42 as amended into claim 1.

Accordingly, Applicants respectfully submit that the asserted combination of Grieser et al and Holtzman et al would not have rendered obvious Applicants' claimed invention as described in claims 42-48. Accordingly, the Examiner is requested to reconsider and withdraw the rejection of Applicants' claims over the asserted combination of references.

For all the foregoing reasons, Applicants respectfully submit that the presently claimed invention fully distinguishes over the prior art, and in particular fully

distinguishes over Mikado et al, both when taken alone and when Mikado et al is taken in combination with any of the cited references with which it has been combined in the present Office Action. Accordingly, Applicants respectfully request withdraw of the rejections of Applicants' claims over the prior art.

**Rejection Under Section 112, First Paragraph**

Claim 9 stands rejected under 35 U.S.C. §112, first paragraph as lacking enabling disclosure. The Examiner asserted that it is not clear how the etchant could achieve an aspect ratio of at least 5. The Examiner apparently failed to understand the etching process, and asserted that much more etchant would contact the grain surfaces than grain boundaries. Applicants note that the purpose of the careful selection of etchant solutions and of the various inhibitors added to the etchant solutions is to protect the grain surfaces with respect to the grain boundaries and to direct the etching to the grain boundaries. Applicants respectfully assert that this would be recognized by a person of skill in the art. Thus, there is no lack of enabling disclosure with respect to the aspect ratio.

With respect to immersion plating, the Examiner is referred to the discussion of immersion plating set forth above.

Accordingly, Applicants respectfully request withdrawal of this rejection.

**Rejections Under Section 112, Second Paragraph**

Claims 1, 14, 25, 29 and 30 stand rejected as reciting improper Markush groups. Applicants respectfully traverse this rejection. Claims 29 and 30 have been canceled, thus mooted this rejection with respect thereto. Claim 14 has been amended to recite, and claims 1 and 25 each specify, that the composition comprises "one or more" of a list of specified ingredients. There is no indefiniteness in the scope

of claims 1, 14 and 25. In each of these claims, the solution or composition clearly and definitely comprises one or more than one of the ingredients specified in the list which follows. None of the ingredients, the list or the number of elements which may be included is in any way indefinite.

In this regard, the Examiner is respectfully referred to Appendix AI (PCT) of the MPEP (Specifically, Ex. 20, p. AI-44 of the July 1998 Ed.); Training Materials For Examining Patent Applications with Respect to 35 U.S.C. Section 112, First Paragraph - Enablement Chemical/Biotechnical Applications, released August, 1996. (Specifically, Ex. H and J). These examples make clear that the phrase "X selected from A, B and C" is proper claim language, and therefore no objection should be raised against this claim language.

In particular, under MPEP 2173.05(h), alternative expressions are permitted if they present no uncertainty or ambiguity with respect to the question of scope or clarity of the claims. See Paragraph II, "OR" Terminology, p. 2100-152 (Rev. 1, Feb. 2000). It is respectfully submitted that the rejected claims are definite, clear and unambiguous with respect to the scope of these claims, and there is no violation of Section 112, second paragraph. Accordingly, Applicants respectfully request withdrawal of the rejection of these claims on this ground.

Claims 2-4 stand rejected as indefinite for reciting "at least about". While Applicants traverse this rejection on the basis that the cited case law is not relevant to these claims, in order to advance the prosecution of the application, Applicants have amended claims 2-4 to overcome this rejection.

Claim 19 stands rejected as indefinite since the Examiner does not understand if there is a loop or if the metal is simply submerged for a finite period of time. Claim 19 has been amended to specify that the immersion plating step is carried out on a continuous basis. The amended claim makes clear that the process is continuous,

including, for example, an automated process of immersion plating of intergranular etched metal substrates.

#### **Drawing Corrections**

Applicants submit herewith corrected drawings, in which the margins have been corrected. No substantive changes have been made to the drawings. The Examiner is respectfully requested to enter the corrected drawings and to withdraw the objection thereto.

#### **CONCLUSION**

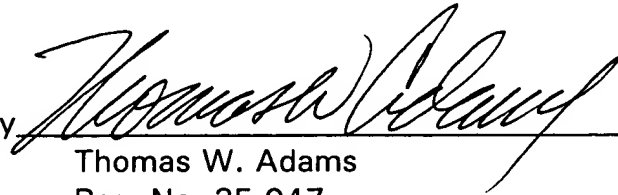
Applicants respectfully submit that, at least for the foregoing reasons, the presently claimed invention is neither anticipated by, nor would have been obvious over Mikado et al, either alone or in combination with the secondary references. Accordingly, Applicants request the Examiner to allow the present claims to proceed to issue.

In the event issues remain in the prosecution of this application, Applicant requests that the Examiner call the undersigned to expedite allowance of the application. No fees are believed required as a result of the present paper; however, in the event fees are required for the filing of these papers the Commissioner is authorized to charge those fees to Deposit Account #18-0988, Docket No. MCGEP0179US.

Respectfully submitted,  
RENNER, OTTO, BOISSELLE & SKLAR, L.L.P.

Date: July 2, 2002

By

A handwritten signature in cursive script, appearing to read "Thomas W. Adams", written over a horizontal line.

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